has a right to take up the study and description of any fossil group until he has made a very careful and exhaustive study of its nearest living allies; but, in addition to this, he ought also to have made himself acquainted with the peculiar mineral changes which organic remains are liable to undergo. He will, moreover, be far more likely to interpret aright and to make the best use of the materials that come to his hand, if he have at least a general knowledge of what others working on similar materials belonging to other departments of the animal or vegetable world have been able to accomplish, and of the methods which they have followed. Such palæontologists, I insist, have as much right to recognition as any other class of biological specialists.

Still less should I wish it to be implied that I think systematic biologists can afford to be ignorant of the results of palæontological studies, in their own particular fields of labour. One of the most mischievous weeds that have accompanied the evolutionist in his incursions into various parts of the biological field is the preposterous "genealogical tree." We can scarcely turn over the leaves of a modern systematic work without finding it flourishing in full luxuriance. No sooner has the student of a particular group arranged his families, genera, and species, than he thinks it incumbent upon him to show their genetic relations. Very admirably has Prof. Alexander Agassiz pointed out the utter fatuity of such a proceeding. As Lyell used to say, in speaking of such proceedings, the imagination of the systematist, untrammelled by an acquaintance with the past history of the group, "revels with all the freedom characteristic of motion *in vacuo.*" If for no other reason, zoologists and botanists ought to study fossil forms in order that, by encountering a few hard facts in the shape of fossils, they may be saved from these unprofitable flights of the imagination.

(*To be continued.*)

## SCIENTIFIC SERIALS.

*Rendiconti del Reale Istituto Lombardo*, December 1887.—On the Tertiary formations near Cape La Mortola, in Liguria, North Italy, by Prof. T. Taramelli. The paper deals specially with the abrupt interruption which occurs in the prevailing Eocene and Secondary systems about this part of the Ligurian coast. This interruption is brought into connection with the great development in Liguria of the marine Pliocene formation, which in the Varo basin and near Ventimiglia stands at a present altitude of over 550 metres above the sea, but which does not occur at all further east in Istria and Friuli, where it is represented by thick alluvial deposits of vast extent.—On the neutralizers of tubercular virus, by Prof. Giuseppe Sormani. In continuation of his previous studies, the author here deals with twenty-one additional substances, or chemical reagents, making eighty altogether. According to their different action on Koch's Bacillus these are grouped in three categories: those that have no effect; those that only attenuate, and those that entirely destroy, the virus. As many as twenty-two, including camphorated chloral, the bromide of ethyl, and the nitrite of ethyl, are found to be effective.—Meteorological observations made at the Brera Observatory during the month of November 1887.

*Rivista Scientifico-Industriale*, January 15.—The crepuscular tints in connection with the hygrometric state of the atmosphere, by Prof. Costantino Rovelli. Constant observation shows that red and orange tints prevail in a dry, yellow and green in a moist, state of the atmosphere. This suggests a threefold division of the solar spectrum into (1) the region of warm rays transmitted by the lower atmospheric strata, and corresponding to a dry condition of the air; (2) the region of middle rays, yellow and green, more easily diffused and partly transmitted by the air in moist weather; (3) the region of cold rays diffused by an atmosphere abounding in aëriform vapour. The terrestrial dust suspended in the air, by condensing the aqueous vapour, as is now generally accepted, may also tend to produce those occasional after-glows of intense brightness, which have been so often observed after violent volcanic eruptions. The various character and intensity of the tints may all be thus explained by the theory of the eclectic transmission of the coloured rays by the corresponding states of the atmosphere, and partly also by the particles of dust held in suspense.—On the constitution of fogs and clouds, by Prof. F. Palagi. These phenomena are attributed to the presence of minute drops of water with diameter of 1/10 to 1/20 mm. at a temperature above zero. The recent observations made by the author on Mount Titano show that when the temperature falls below zero these globules are converted into minute hexagonal needles and flakes of the same form, the former about 1/20 mm. thick, and from two to ten times longer, the latter from 1/10 to 1/4 mm. in diameter. In their passage from the higher regions through the lower and less cold strata, but still below zero, these simple crystalline forms appear to be transformed by the process of condensation and agglomeration into the stars and flakes of ordinary snow. But when the temperature rises above zero they are again changed to the minute liquid drops of clouds, fog, and rain according to the varying degrees of altitude and temperature.

*Bulletin de l'Académie des Sciences de St. Pétersbourg*, vol. xxxii. No. 1.—On the effects of the earthquake of February 23, 1887, at the Observatory of Pavlovsk, by Dr. Wild (in German). The effects of the catastrophe having been observed at the Observatories of England, France, Italy, Germany, and Austria, in trepidations of the magnetic instruments, it was interesting to see whether the earthquake was felt as far as St. Petersburg. The results indicate that it was not.—On the genus Hemiculter and a new species of Hemiculterella, by N. Warpachowski (in German).—Russian words used in the Sagai dialect, and their phonetic modifications, by N. Katunoff; and lists of Sagai names of rivers, villages, and tribes, by the same. This little dictionary is highly spoken of by M. Radlof.—Studies, by O. Backlund, about the Pulkowa catalogue of stars, "Positions moyennes de 3542 étoiles," published in 1886 (in German). A detailed comparison of the Pulkowa catalogue with the measurements by Herr Romberg at Pulkowa, as also with the catalogues of Becker, Respighi, and Boss.—Hydrological researches, by Dr. Carl Schmidt.—The temperature-maxima before midday in tropical seas, according to the observations of the corvette *Vityaz*, by M. Rykatcheff (in German). They show the existence of two separate maxima, one of which sets in half an hour before midday and the other half an hour later. More extensive observations are needed.—On the synthesis of albumen in chlorophyll-bearing plants, by Chrapowitzki (in German). The chlorophyll spots must be considered as places where synthesis of both carbohydrates and albumen is going on.—New additions to the Asiatic Museum, by C. Salemann. Summaries of two Persian and three Kagatai manuscripts brought in by M. Pantusoff from the Semiryetchensk province.

THE *Izvestia* of the Russian Geographical Society (1887, iv.), contains most valuable papers and maps. Dr. Junker contributes a report on his seven years' journeys in Equatorial Africa, and his paper is accompanied by a map, 53 miles to the inch, of the region extending for ten degrees on the north of the Equator, between the 22nd and 33rd degrees of longitude. Two papers, by M. Potanin, contain a summary of the information gathered from the natives as to Eastern Tibet (the regions of Amdo and Kam), and the region of Central Mongolia situated between the Nan-shan, the Khangai, Hami, and the Utai-shan. Both papers are accompanied by maps, on a scale of 100 miles to an inch, and the two maps complement one another, so as to give a very accurate idea of the upper Hoang-ho. Of the other papers, one by M. Krasnoff, on the manners of life of the Kirghizes in the Semiryetchensk province, will be welcome to ethnographers. The same number contains also a list of fifteen places in Laponia, the latitudes and longitudes of which have been measured in 1864 by Captain Ernefeld; and, in a separate appendix, tables, by Prof. Sharnhorst, for the calculation of heights from barometrical observations. It is self-evident, although it is too often lost of sight, that the calculation of heights upon observations of the barometer, when it is made by means of logarithms, means a much greater accuracy of results than anything that can be obtained from a few observations of atmospheric pressure during a journey, and that some plainer tables would give the results with an accuracy quite sufficient for the accuracy of the data themselves. M. Sharnhorst's tables are an improvement upon those formerly in use, and ought to be introduced into every manual for travellers, instead of the usual logarithmical tables.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, January 26.—"Report on Hygrometric Methods. First Part, including the Saturation Method and the Chemical Method, and Dew-point Instruments." By W. N.

Shaw, M.A. Communicated by R. H. Scott, F.R.S., Secretary to the Meteorological Council.

With the exception of certain "absolute hygrometers," the behaviour of which has not yet been sufficiently tested, the determination of the pressure of water-vapour in the air is indirect, and requires a formula of reduction. The formulæ in use are based upon assumptions which are at present not so completely verified by experiment that any hygrometric method can be relied upon to give measures of the pressure of aqueous vapour trustworthy to within 0·1 mm. of mercury. The authority for these statements is given in detail in an account of the hygrometric work done since 1830, appended to the report as Note A.

In the report, the chemical hygrometric method is provisionally regarded as a standard.

The assumptions upon which the formula of the method is based are (1) that it is possible to absorb the whole of the moisture from air by passing it over desiccating substances; and (2) that a numerical value can be assigned to *d*, the specific gravity of aqueous vapour referred to air at the same temperature and pressure. The first assumption is sufficiently nearly accurate for hygrometric observations. With regard to the second, Regnault's direct observations upon steam (free from air) and other evidence point to the value 0·622. The assumption can, moreover, be tested, by applying the chemical method to air saturated at a known temperature, assuming the value 0·622 for *d*, and comparing the results with the table of saturation pressures *in vacuo*. This, however, *assumes Dalton's law to be strictly accurate*, an open question upon which opinion is reserved until further experimental investigation is concluded. Regnault found that the value 0·622 gave results for saturated air which were less than the tabulated pressures, the errors being always of the same sign, but so small in amount that he neglected them in his subsequent work.

The ultimate object of the experiments described in the report was to examine the behaviour of dew-point instruments in air of known state, and for this purpose air was saturated at a known temperature and drawn by an aspirator through vessels in which the dew-point instruments could be placed when required, and subsequently through drying tubes of special pattern. The vapour-pressure was thus obtained at the two extremities of the train of apparatus and the results compared.

The following questions are raised and discussed:—

(1) Were the drying tubes used as efficient as Regnault's? (2) Does the pressure of vapour in the air become changed by passing through the apparatus designed to contain the dew-point instruments, or by the mere presence of those instruments themselves? (3) Do the results of the chemical method agree with the tabulated vapour-pressures *in vacuo* when the air is more or less heated after being saturated? (4) Can the observed differences between the results be obviated by assuming a value for *d* (other than 0·622), which is compatible with values obtained by other methods? (5) Can any reason be assigned for the differences observed by Regnault in the case of saturated air?

(1) The answer to the first question is given in an account of a series of twelve experiments practically repeating Regnault's observations with saturated air. The tabulated results show divergences in the same direction and of the same order of magnitude as those in Regnault's paper. Some incidental points are also discussed—namely, the comparative efficiency of phosphoric anhydride, sulphuric acid, and calcium chloride, and the effect of india-rubber and glass connections between drying tubes. It is shown that the sulphuric acid and phosphoric anhydride tubes are efficient, that as a rule one tube is all that is strictly necessary, but that two should be used to provide for the case of exhaustion of the first tube or too rapid flow of air, and further, that the glass-and-mercury connections between the tubes employed in the second series of experiments cannot be regarded as producing any effect.

(2 and 3) The answers to the second and third questions are furnished by the results of eighty-two experiments with the chemical method upon air saturated at known temperatures by a specially designed "saturater" in a water-bath. The temperatures of saturation lay between 1° C. and 21° C., and, with one exception, were below the temperature of the surrounding air. Each experiment involves upwards of thirty readings of weight, pressure, and temperature. The temperature readings are corrected by means of a special comparison at Kew. Of the eighty-two observations thirty-two are retained as being free from any known disturbing causes, and from them it appears that, with *d* equal to 0·622, the pressure deduced by the chemical method is on the average greater by 0·03 mm. than that given in Regnault's table of vacuum pressures, as recalculated in Landolt and Börnstein's tables. This difference is very small compared with the discrepancies from Dalton's Law observed by Regnault in the case of water vapour.

(4) With regard to the fourth question; if the observations be employed to determine the value which must be substituted for *d*, the value obtained is 0·6245, which agrees very closely with 0·6240, the mean value for the same range of temperature deduced from Clausius's calculations based on thermo-dynamical reasoning. The value 0·622 is probably correct if the air is not nearly saturated; in that case the measure of the pressure of vapour in the air is 2/622 greater than it would be if the same air were reduced in temperature (at constant pressure) until it was saturated.

(5) The one observation of the second series with saturated air gives a result 0·18 mm. smaller than the tabulated pressure, and thus with the twelve experiments of the first series confirms the results of Regnault's observations. To account for this it is suggested that air which is very nearly or quite saturated would deposit some of its moisture on the glass tubes used to conduct it from one vessel to another. This behaviour of nearly saturated air has been already noticed, and it is confirmed by the observations on dew-point instruments, and moreover, by experiments, directly designed for the purpose, quoted in a note.

Details are given of observations with Regnault's hygrometer and Dines's hygrometer when exposed in glass vessels between the saturater and the drying tubes. The two instruments are separately discussed. With Regnault's instrument, after some practice, two different observers obtained practically identical results. In ordinary observations, the observed temperatures of the dew-point were below the temperature of saturation, but seldom by more than 0°·1 C. A considerable amount of uncertainty was shown to be attached to the readings, and by very close inspection readings of the dew-point were obtained above the temperature of saturation, in one case by as much as 0°·7 C.

From the experiments with Dines's hygrometer, it appears that the instrument is likely to give very easy determinations of the dew-point that are within small limits of error; but that, if it be observed with the closest attention, the result will be considerably too high in consequence of the formation of a dew deposit at a temperature above the dew-point, and it may possibly be erroneous in consequence of variations in temperature of the different parts of the box containing the thermometer.

An account is given of Alluard's modification of Regnault's hygrometer, and of Bogen's hygrometer.

A second note, B, is appended to the report, showing the tables used in various countries for the reduction of wet and dry bulb observations.

**Chemical Society**, February 2.—Mr. W. Crookes, F.R.S., in the chair.—Profs. Geuther, Ladenburg, Landolt, Nilson, Van't Hoff, Wislicenus and M. Lecoq de Boisbaudran were elected foreign members of the Society.—The following lecture was delivered:—The range of molecular forces, by Prof. A. W. Rücker, F.R.S. In discussing the range of molecular forces it is convenient to adhere to the language of the theory of action at a distance, though with full expectation that it will ultimately be replaced by another, such as the vortex-atom theory of Sir W. Thomson, or the granular theory of Prof. Osborne Reynolds, which involves only action in proximity. If we do this, however, it must be admitted that the law of molecular action may be very complicated. It may be granted that we naturally look for simplicity in our fundamental assumptions, but it is certain that we have *a priori* no more right to expect simplicity in the results of the action of a medium than simplicity in its constitution, and that the two are not necessarily obtained together. The largest values of the magnitude of the radius of molecular action which have been published have been deduced from observations on the condensation of gases and vapours on the surfaces of solids. Estimates on this basis made by Müller-Erzbach (*Exner's Rep.*, 1885, xxi. 409) and Kayser (*Wied. Ann.*, 1881, xiv. 450) have ranged between 1500 and 3000 micromillimetres[1] ($\mu\mu$). Such observations are open to many objections. Bunsen (*Wied.*, 1885, xxiv. 335) has shown that $CO_2$ will not condense on glass unless a film of water be previously formed. Warburg and Ihmori (*Wied.*, 1886, xxvii. 481, and *Wied.*, 1887, xxxi. 1006) adduce reasons for believing that the water film is largely due to uncombined or loosely combined alkalies on the surface. On clean unvarnished metals, washed glass and quartz, the thickness of the water film which can be removed by dry air without heating does not exceed 12 μμ. A striking exception is agate, on which films 1640 μμ thick are stated to have been formed. As this substance, however, is composed of alternate layers of quartz and a porous impure opal, the basis for an accurate calculation does not exist. On the whole, it seems that no definite conclusions as to the magnitude of the radius of molecular action ($\rho$) can at present be drawn from these experiments. Quincke (*Pogg. Ann.*, 1869, cxxxvii. 402), as is well known, by measuring the capillary elevation of liquids between glass plates coated with thin wedge-shaped films, found $\rho = 50$ μμ. Plateau ("Statique des Liquides," 1873, i. 210) showed that the surface-tension of a soap-bubble, which thinned until its thickness was 118 μμ, was unaltered. He concluded that $\rho < 59$ μμ. Maxwell ("Ency. Brit.," 9th ed., Art. "Capillary Action"), however, though by a confessedly imperfect theory, shows that the surface-tension may not change until the thickness of the film $= \rho$. Hence Plateau's result may mean only that $\rho < 118$ μμ. Reinold and Rücker (Phil. Trans., clxxvii. Part ii. 1886, 627) have proved that the surface-tension does not alter by 0·5 per cent, when the film is so thin as to show the black of the first order of Newton's colours. This appears at first sight at variance with Quincke's result, but their observations are really in remarkable accord with his. The black and coloured parts of a film are separated by a sharp line, which proves a discontinuity in the thickness (Proc. Roy. Soc., 1887, No. 182, 340). The colours, which correspond to certain thicknesses, which may be called the unstable range of thickness, are always missing. The black part of the film has been proved by Reinold and Rücker (Phil. Trans., Part ii. 1883, 645) to be of a uniform thickness, which differs but little from 12 μμ. Sir William Thomson (Proc. Royal Institution) and these observers independently arrived at the conclusion that these curious phenomena are due to the fact that the surface-tension diminishes to a minimum, and then increases again when the thickness is somewhat $>12$ μμ. The colours of the film prove that the upper limit of the range of unstable thickness is between 96 and 45 μμ. Quincke's result indicates that it lies between 100 μμ and 50 μμ, according as we adopt Plateau's or Maxwell's views. These calculations are therefore in complete accord. Quincke's result is not an isolated fact, but is supported by observations on soap films. The statement that 50 μμ and the radius of molecular action are of the same order of magnitude may now perhaps rank as an ascertained fact. Another method of investigating the radius of molecular action is based on the phenomena of electrolytic polarization, by observing the change in the difference of potential between a metal and a liquid in which it is immersed, when a gas or metal is deposited on it by electrolysis. In the former case we do not know the density of the gas, in the latter Oberbeck (*Wied.*, 1887, xxxi. 337) concludes that a plate of platinum is completely polarized by a film of another metal of from 3 to 1 μμ in thickness. The method of experiment is, however, open to objections, which are indicated by Oberbeck himself. Measurements of the thickness of the double electric layer of Helmholtz, which is closely related to the distance between two consecutive layers of molecules, have been made by Lippmann (*Compt. rend.*, 1882, xcv. 687), and by Oberbeck and Falck (*Wied.*, 1884, xxi. 157). The values they give vary between 1 and 0·02 μμ. Wiener (*Wied.*, 1887, xxxi. 624) has studied the alteration in the phase of light reflected from very thin silver plates deposited on mica. He finds that the effect begins to alter when the thickness is reduced to 12 μμ, and that it was possible to detect a silver film the thickness of which did not exceed 0·2 μμ. The diameter of a molecule is a conventional term for the mean distance of the centres of two molecules during an encounter. It may therefore be different in the liquid and gaseous states. Sir William Thomson ("Natural Philosophy," Thomson and Tait, Part ii. 295, 1883), as the result of his celebrated discussion of this point, concludes that the mean distances between the centres of molecules in liquids (supposed arranged uniformly) is between 0·07 and 0·02 μμ, and that the latter quantity is an inferior limit to the diameter of a gaseous molecule. The diameters of molecules ($d$) may be calculated if we know the mean free path (L), and the so-called condensation coefficient ($v$), which is the volume of the molecules contained in a unit volume of the gas. Loschmidt (*Sitzungsber. Wien. Akad. Math. Classe*, lii. abt. 2) and O. Meyer ("Die Kinetische Theorie der Gase," 225, 1887) have calculated $d$ on the assumption that the molecules in a liquid practically fill the whole space it occupies. Exner (*Rep. der Physik*, xxi. 226, 1885), using a formula given by Clausius, $v = (K - 1)/(K + 2)$, where K is the specific inductive capacity, and can be replaced by $v = (n^2 - 1)(n^2 + 2)$, where $n$ is the refractive index, finds values of $d$ about five times smaller. Three independent methods of calculating the diameter of a gaseous hydrogen molecule lead to results between 0·14 and 0·11 μμ. The most reliable conclusions which have been reached as to molecular magnitudes may be summed up in the following table, which is reproduced from a diagram exhibited during the lecture.

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[1] The micromillimetre is the millionth of a millimetre.

| μμ. | | |
|---|---|---|
| 118 | Superior limit to $\rho$ ... ... ... | Plateau (Maxwell) |
| 96–45 | Range of unstable thickness begins ... ... ... ... ... | Reinold and Rücker |
| 59 | Superior limit to $\rho$ ... ... ... | Plateau |
| 50 | Magnitude of $\rho$ ... ... ... | Quincke |
| 12 | Range of unstable thickness ends ... ... ... ... ... | Reinold and Rücker |
| 12 | Action of silver plate on phase of reflected light alters ... | Wiener |
| 10·5 | Thickness of permanent water film on glass at 23° C. ... | Bunsen |
| 4·3 | Mean distance between centres of molecules in gases at 760 mm. and 0° C. ... ... | O. Meyer |
| 3–1 | Thickness of metal films which polarize platinum ... ... | Oberbeck |
| 1–0·02 | Thickness of electric double layer ... ... ... ... .. | Lippmann and Oberbeck |
| 0·2 | Smallest appreciable thickness of silver film ... ... .. | Wiener |
| 0·14–0·11 | Diameter of gaseous hydrogen molecule ... ... ... ... | Exner<br>O. Meyer<br>Van der Waals |
| 0·07–0·02 | Mean distance between centres of liquid molecules ... ... | W. Thomson |
| 0·02 | Inferior limit to diameter of gaseous molecule ... ... ... | W. Thomson |

—The following papers were read:—A new method of obtaining monohydrazides of α-diketones, by Prof. F. R. Japp, F.R.S., and Dr. F. Klingemann. The authors have prepared von Pechmann's monohydrazide of diacetyl by the action of diazobenzene chloride on sodium methacetate.—The formation of dihydrazides of α-diketones, by the same.—The action of phenylhydrazine on anhydracetophenonebenzil, by Prof. F. R. Japp, F.R.S., and Mr. G. N. Huntly.—The supposed identity of rutin and quercitrin, by Dr. E. Schunck, F.R.S. A comparative examination of rutin obtained from the leaves of *Polygonum fagopyrum* and of quercitrin shows that, though they are extremely similar, yet they differ in composition and in some of their properties. Rutin has the composition $C_{42}H_{50}O_{25}$, and yields, on hydrolysis, one molecule quercetin and three molecules isodulcite, whilst quercitrin $C_{36}H_{38}O_{20}$, as is known, yields, under like conditions, one molecule quercetin and two molecules isodulcite.—The composition of bird-lime, by Dr. E. Divers, F.R.S., and M. Kawakita. Japanese bird-lime prepared from *Ilex integra* contains, in addition to 6 per cent. of caoutchouc and minute quantities of oxalates, the ethereal salts of palmitic acid, and, in small quantity, of a semi-solid undetermined fatty acid. On hydrolysis these yield *ilicylic alcohol*, $C_{22}H_{38}O$, differing only slightly from Personne's ilicic alcohol, and *mochylic alcohol* $C_{26}H_{46}O$. A resinoid body, $C_{26}H_{44}O$, was also separated. When heated with palmitic acid, the two alcohols are converted into compounds just like purified bird-lime. The authors consider bird-lime to be closely allied to the *waxes* in chemical constitution.

ERRATA.—P. 335, line 15 (from top), *for* $3SOH_2SO_4$ *read* $3H_2SO_4$; line 19 (from top), *for* SO *read* $SO_2$.

**Physical Society,** January 28.—Prof. W. G. Adams, F.R.S., Vice-President, in the chair.—In opening the proceedings the Chairman referred to the great loss which the Society had sustained by the death of Dr. Balfour Stewart, their late President, and said that his loss would be deeply felt by the whole scientific world.—The following papers were read:—On the effect of magnetization on the thermo electrical properties of bismuth, by Mr. Herbert Tomlinson.—On the influence of magnetism and temperature on the electrical resistance of bismuth and its alloys with lead and tin, by M. Ed. von Aubel.—On a water-dropping influence machine, by Prof. S. P. Thompson.—On the price of the factor of safety in lightning-rods, by the same. It is here shown, upon certain assumptions, that the safety against fusion varies as total cost $\times \frac{f s}{\rho d l^2 k}$, where $f$ = temperature of fusion of material above atmosphere, $s$ = specific thermal capacity, $\rho$ = specific electric resistance, $d$ = density, $k$ = cost in pence per lb., and $l$ = length of the conductor. If the total cost and length are supposed to be given, the factor of safety $= \frac{f s}{\rho d k}$. Of the common metals iron has the greatest factor of safety, being more than four times that of copper. Such being the case, the author thinks it desirable that the Report of the Lightning-Rod Conference be reconsidered.—On the optical demonstration of electrical stress, by Prof. A. W. Rücker, F.R.S., and Mr. C. V. Boys. A number of lecture experiments were shown illustrating that electrical stress exists in the dielectric separating two charged bodies. The bodies were placed in carbon bisulphide, between two crossed Nicols, and on electrifying them by means of a Holtz machine, light passed through the analyzer. Two concentric cylinders gave a black cross on the screen similar to those seen on interposing a plate of some uniaxial crystal, and a model illustrating a charged Leyden jar was shown.

February 11.—Annual General Meeting.—Dr. J. H. Gladstone, F.R.S., Vice-President, in the chair.—The Chairman read the Report of the Council for the past year, and expressed regret at the losses the Society had sustained by the deaths of Dr. Stewart (their late President), Prof. Kirchhoff, Mr. Coutts Trotter, and Prof. Humpidge. The Council regret that no increase of members has taken place during the past year, and hope that the advantages offered by the Society may be more fully appreciated in future. Obituary notices of Dr. B. Stewart, Mr. Coutts Trotter, and Prof. Humpidge were then read. The Treasurer's Report shows that the financial condition of the Society is very satisfactory. On the motion of Mr. Lant Carpenter, seconded by Mr. Inwards, the Reports were adopted.—The following gentlemen were elected members of Council for the present year:—President: Prof. A. W. Reinold, F.R.S. Vice Presidents: Dr. E. Atkinson, Prof. W. E. Ayrton, F.R.S., Mr. Shelford Bidwell, F.R.S. and Prof. H. McLeod, F.R.S. Secretaries: Mr. Walter Baily, and Prof. J. Perry, F.R.S. Treasurer: Prof. A. W. Rücker, F.R.S. Demonstrator and Librarian: Mr. C. V. Boys. Other members of Council: Hon. R. Abercromby, R. H. M. Bosanquet, M.A., W. H. Coffin, Conrad W. Cooke, Prof. F. Fuller, W. N. Shaw, A. Stroh, Prof. S. P. Thompson, H. Tomlinson, G. M. Whipple. On taking the chair the new President expressed his sincere thanks for the great honour the Society had conferred upon him. Prof. Fuller proposed a vote of thanks to the Lords of Committee of Council on Education for the use of the rooms and apparatus of the Normal School of Science, which was seconded by Mr. Shaw, and passed unanimously. A cordial vote of thanks to the Council and officers of the past year, moved by Dr. Blaikley, and seconded by Prof. Ramsay, was duly acknowledged by the President. A similar vote, proposed by Mr. Bosanquet, and seconded by Mr. Hadden, to the auditors for the past year, was passed unanimously.—The meeting was then resolved into an ordinary science meeting, at which the following papers were read:—On the limit of refraction in relation to temperature and chemical composition, by Mr. T. Pelham Dale.—Note on the use of the term "resistance" in the description of physical phenomena, by Mr. R. H. M. Bosanquet.

### PARIS.

**Academy of Sciences,** February 13.—M. Janssen in the chair.—On an ancient process for rendering gems and vitrifications phosphorescent, by M. Berthelot. The treatise in which this process is described occurs in the collection of Greek alchemists transcribed in certain manuscripts of the thirteenth and fifteenth centuries (Bibliothèque Nationale, Nos. 2325 and 2327). It contains a series of purely technical receipts analogous to those of the Leyden papyrus, some apparently of great antiquity, explaining certain methods of "colouring artificial precious stones, emeralds, carbuncles, hyacinths, according to the book taken from the shrine of the Temple." Several Egyptian alchemists are mentioned, such as Agathodemon, the pseudo-Moses, Ostanes, and Democritus, and the text leaves no doubt as to the ancient practice of rendering certain gems phosphorescent in the dark by means of surface colouring prepared from substances which are still known to possess such properties.—On the properties of a new hydraulic machine intended for irrigation purposes, by M. A. de Caligny. For this apparatus, which has been for some time in use both at Aubois and on the canal between Mons and La Louvière, the author claims the advantages of great simplicity of structure as well as economy on the first outlay. It may also be utilized for replenishing cattle-troughs, and other secondary uses, at a minimum cost. It was awarded a gold medal at the Antwerp Universal Exhibition.—On the part played by the absorbing power of the soil in the formation of the natural carbonates of soda, by M. Paul de Mondesir. The paper deals with Berthollet's well-known theory regarding the formation of Egyptian natron, and shows that Berthollet's explanation is so far true that the marine salt really furnishes the soda, and carbonate of lime, the carbonic acid. But the reaction is neither direct nor continuous, and is produced in two distinct phases. In the first, the soil reacts on the marine salt, transforming it into chloride of calcium while yielding lime and absorbing soda. In the second, which can set in only after removal of the chloride of calcium, the bicarbonate of lime and the carbonic acid extract the soda from the ground, replacing it with lime. Berthollet's theory is thus left fundamentally intact, but so modified as to become universally applicable. In fact, the carbonate of soda is produced in all permeable calcareous soils in proportion to the quantity of marine salt contained in them.—Observations of the new planet 272, discovered on February 4, at the Observatory of Nice, by M. Charlois. The observations, including right ascension, polar distance, and the positions of comparison stars, extend over the period from February 4 to February 9. When discovered the planet was of 13·5 magnitude.—New observations on the variability of Saturn's rings, by M. E. L. Trouvelot. It is pointed out that the observations made during the last few years by Perkins, Offord, Davis, Stanley Williams, Stroobant, and others, all tend definitely to establish the proposition announced by the author in 1884, that, so far from being stable, the rings of Saturn are on the contrary essentially variable, and subject to constant fluctuations. The same truth is confirmed by the author's own observations made in 1886 and 1887 at the Observatory of Meudon, and here communicated to the Academy.—Theorems on Campbell's algebraic equations and quadratic functions, by Father Aug. Poulain. Newton, or rather Campbell, formulated a very simple rule for determining the existence of the imaginary roots in algebraic equations. The author here proposes a few theorems, by means of which the application of this law may be extended and the accompanying calculations much simplified.—On chemical equilibria, by M. P. Duhem. In a recent note M. H. Le Chatelier announced that the numerical laws of chemical equilibrium, as deduced from the two principles of thermodynamics, may be expressed in a simple way by means of M. Massieu's characteristic function H′. Here it is shown that this law may be thus formulated: The variation imposed on M. Massieu's function H′ by a virtual isothermic modification of the system is equivalent to zero. It is further pointed out that the results obtained by M. Le Chatelier are practically identical with those arrived at by the author during a series of investigations spread over several years.—On the mineralizing action of the alkaline sulphides: reproduction of chrysoberyl, by MM. P. Hautefeuille and A. Perrey. During a protracted series of researches on the mineralizing action of the sulphides, the authors have succeeded in obtaining the crystallization of glucine, the separation of alumina and glucine, or inversely the reproduction of the aluminate of glucine, a combination which occurs in nature, and which is known by the name of cymophane (chrysoberyl). A simple process is described by means of which from a combination of glucine and alumina extracted from the emerald the glucine may be obtained with a loss of not more than 10 per cent., and in such a state of purity that its equivalent has been found equal to 12·58.—Influence of various diets on the interchange of the gases in respiration, by MM. Hanriot and Ch. Richet. Continuing their researches on the respiratory function, the authors find that respiration increases with the increase of food, but only when this consists of the hydrates of carbon; that the interchange of the gases is but slightly affected by a nitrogenous and fatty diet; that feculent substances increase the absorption of oxygen and especially the production of $CO_2$; that the centesimal proportions of the absorbed oxygen or of the generated carbonic acid varies little during muscular repose; that the proportion of absorbed oxygen averages about 4·2 per cent., and of generated $CO_2$ about 3·4 per cent. The subject is illustrated by a diagram showing by a graphic process the influence of a nitrogenous and feculent diet on the respiratory functions generally.—Discovery of a worked flint and a mammoth's tusk at Vitry-en-Artois, by M. Ladrière. The position in which these remains were found seems to confirm the author's view that towards the close of the early Quaternary epoch (Mousterian age) *Elephas primigenius* and other large mammals, as well as man, were already spread over the west of Europe.

### BERLIN.

**Physical Society**, January 20.—Prof. von Helmholtz, President, in the chair.—Prof. Oettingen spoke on the interference of electrical vibrations which is produced by the electrical oscillations discovered by Feddersen, during the spark discharge. The discharge oscillations of two Leyden batteries, differing in frequency and amplitude, were allowed to produce an interference in the path of a third spark, and this led to a constant succession of alternatingly increased and diminished intensities of this spark. The phenomenon was analyzed by means of a rotating mirror, which resolved it into its several phases, and the events taking place in each spark were recorded by instantaneous photography. The speaker exhibited a large number of these photographs, both as negatives and as positive reproductions, and explained them fully. In these experiments, as in those described at the previous meeting of the Society on the explosion of an electrolytic mixture of oxygen and hydrogen, Prof. Oettingen had succeeded in obtaining accurate results only when he had replaced the concave rotating mirror by a plane one, whose action he then thoroughly discussed.—Prof. Börnstein exhibited a preparation which he had recently obtained quite by chance, during one of his lectures. When lecturing on the diffusion of liquids, he was in the habit of using a Traube artificial cell. On placing a blue crystal of sulphate of copper in a solution of soluble glass, a precipitate is formed as a film on the surface of the salt, when it comes in contact with the soluble glass. The water from the solution then diffuses through the film, dissolving the salt and stretching the film until it is ruptured at some one point. When this occurs the solution of the sulphate of copper comes again into contact with the soluble glass, a new film is formed at the surface of contact, closing up the aperture, and the diffusion begins again. The film thus grows continually in a tubular form, until it finally permeates the whole solution. When recently repeating this lecture experiment, the speaker noticed that the film did not grow in the usual tubular way, but took the form of flattened parallel membranes which advanced through the solution at right angles to their length. He was at present unable to offer any explanation of this latter phenomenon.—Dr. Budde had recently submitted Clausius's fundamental law of electro-dynamics to a recalculation, while taking into account a large series of special conditions; among these he allowed for the motion of translation of the earth, and found that it had no influence on the validity of the law. At that time he had not calculated the influence of the earth's rotation; he had however, since then, repeated his former work, and gave an account of the results of his calculation, which showed that the rotatory motion of the earth had also no influence on the law. The same speaker finally drew attention to an error which occurs in all text-books, in connection with the determination of the potential of a system of points, and showed how illogical is the usual definition and of deducing of potential energy. Prof. von Helmholtz then directed attention to the fact that he was in the habit of determining potential energy in a different way, and that its derivation from a system of points is fraught with great difficulties.

## BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Contributions to the Palæontology of Brazil: C. A. White (Washington).—Die Entstehung der Arten, 1 Thiel: Dr. G. H. T. Eimer (Fischer, Jena).—Key to Todhunter's Differential Calculus: H. St. J. Hunter (Macmillan).—Annals of the Astronomical Observatory of Harvard College, vol. xiii. Part 2, Zone Observations made with the Transit Wedge Photometer (Wilson, Cambridge, Mass.).—Calendar and General Directory of the Department of Science and Art for the year 1888 (Eyre and Spottiswoode).—Electrical Instrument Making for Amateurs: S. R. Bottone (Whittaker).—Practical Education: C. G. Leland (Whittaker).—Volapük, or Universal Language: A. Kirchhoff (Sonnenschein).—Geology: Chemical, Physical, and Stratigraphical, vol. ii.: J. Prestwich (Clarendon Press).—Observations made during 1883 at the U.S. Naval Observatory (Washington).—Die Prähistorischen Denkmäler der Provinz Westpreussen und der Angrenzenden Gebiete: Dr. A. Lissauer (Williams and Norgate).—The Shell Collector's Hand-book for the Field: J. W. Williams (Roper and Drowley).—My Telescope: A Quekett Club Man (Roper and Drowley).—Through the Yang-tse Gorges: A. J. Little (Low).—Report on the Administration of the Meteorological Department of the Government of India in 1886-87.—Indian Meteorological Memoirs, vol. iii. Part 2 (Calcutta).—A Manual of the Geology of India; Part 4, Mineralogy: F. R. Mallet (Trübner).—Bulletin of the U.S. Geological Survey, No. 39 (Washington).—The Law of the Universe: G. W. Cleverley (Brown, Hull).—Quarterly Journal of the Geological Society, vol. 44, Part 1, No. 173 (Longmans).—Proceedings of the Linnean Society of New South Wales, 2nd series, vol. ii. Part 3 (Sydney).—List of Contributors to ditto, 1st series (Sydney).—Quarterly Journal of Microscopical Science, February (Churchill).—Journal of the Royal Microscopical Society, February (Williams and Norgate).

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